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(71) Applicant(s)
John Bell
71 Honeywell Grove, BARNSLEY, South Yorks, S71 1QH, United Kingdom

(72) Inventor(s)
John Bell

(74) Agent and/or Address for Service
John Bell
71 Honeywell Grove, BARNSLEY, South Yorks, S71 1QH, United Kingdom

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WPI Acc. No. 2000-213427 & JP110342161 A

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(54) Abstract Title
Pressure sensing devices for pressure or bed sore prevention

(57) The invention relates to a pressure sensing device and also to a matrix of such devices incorporated into a mattress.

There is provided a pressure sensing device comprising a pair of electrical contacts, of which the resistance between the contacts varies according to the pressure applied to the device.

By connecting the one or more pressure devices to a reading means it is possible to obtain a read out of the pressure applied to different regions of the mattress and so assess the likelihood of pressure sores developing.

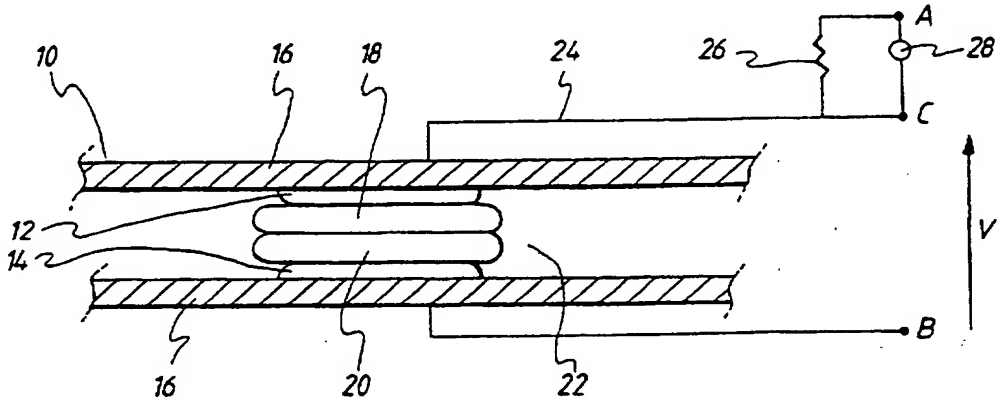

FIG.1

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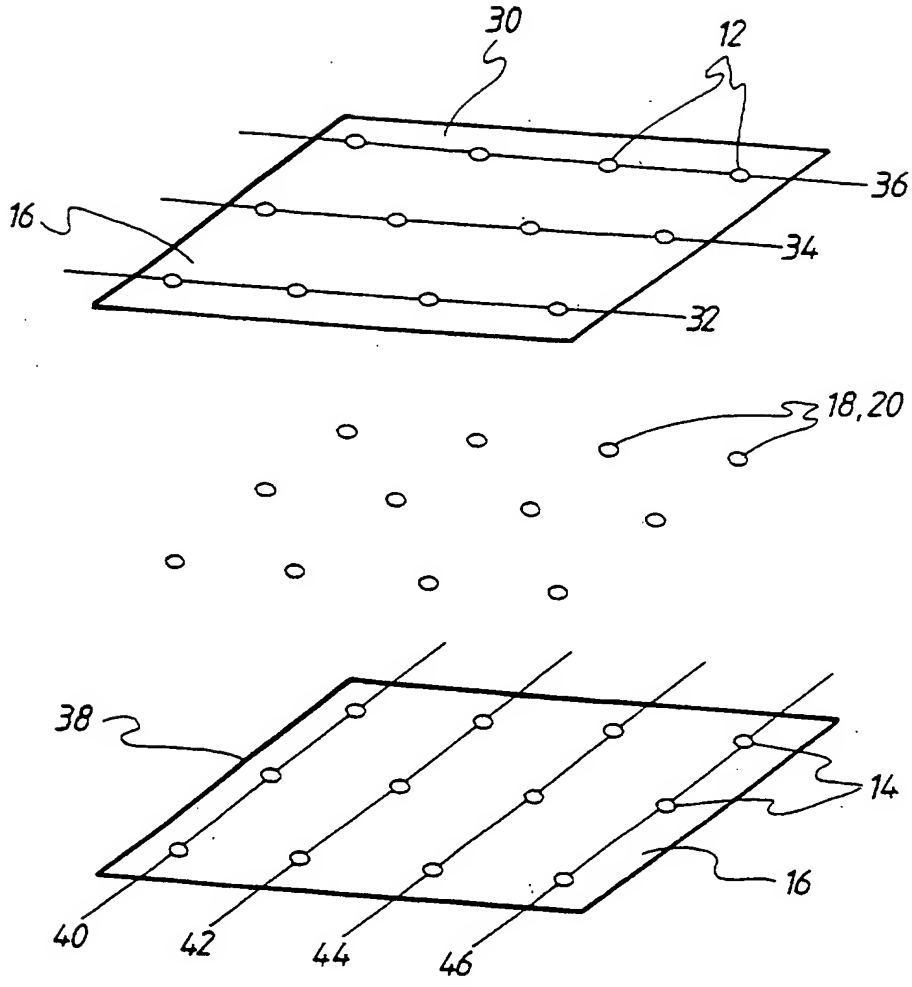

FIG.3

material printed onto a flexible sheet of a plastics material. The conducting material may comprise copper, silver or carbon.

Preferably the contacts are formed from a material having an electrical impedance value at least 1 kilo ohm and this material may comprise a plastics material such as polyvinylchloride impregnated with carbon.

In a second aspect of the invention there is provided a matrix of pressure sensors incorporated into a mattress and connectable to a scanning means such that the pressure distribution between the body of a person lying on the mattress and the mattress can be monitored.

Preferably the sensors are flexible and the matrix is mounted on a backing sheet of flexible plastics material.

Preferably the matrix is mounted on the upper surface of the mattress and there may be holes provided in the backing sheet and the mattress to allow the passage of moisture through the mattress.

There may be an alarm connected to the monitoring system to alert a carer when the body weight distribution of the person lying on the mattress has remained unchanged for a given period of time.

In a third aspect of the invention there is provided a method of measuring the body weight distribution of a prone patient, said method comprising the steps of:-

a) resting the patient on a mattress provided with a matrix of pressure sensors;

Fig. 1 is a cross section through a pressure sensor according to the invention;

Fig. 2 is a plot of the contact resistance against pressure for the material from which the pressure sensing plates are made;

Fig. 3 is an exploded view showing the construction of the matrix of pressure sensors.

Fig. 1 shows a pressure sensing device 10 comprising two electrical contacts 12, 14, each mounted on a flexible backing layer 16. The backing layer may comprise an insulating plastics material such as polyethylene or acetate and the electrical contacts 12, 14 are printed onto the backing layers so that the pressure sensing device 10 will be flexible. The electrical contact 12 is connected to a plate 18 whilst the contact 14 is connected to a plate 20. The two plates 18, 20 are in surface to surface contact so that an electric current can pass from one side of the pressure sensing device to the other. The plates 18, 20 are made from a semi conducting material having an impedance value of at least 1 kilo ohm and, when the two plates are in surface to surface contact, having a contact resistance which varies linearly according to the pressure applied to the sensor 10.

Fig. 2 shows a plot of contact resistance for the material of the plates 18, 20 against pressure applied to the sensing device and it can be seen that from a maximum when no pressure is applied, the contact resistance decreases gradually until the pressure reaches a value of P. When the pressure has a value in the region between P and Q, the curve is substantially linear and when the pressure is higher than Q, the contact resistance begins to decrease more gradually

voltage drop across A-B. Once this value is known the corresponding pressure value can be determined according to contact resistance pressure relationship defined in Fig. 2.

Fig. 3 shows how a matrix of pressure sensing devices can be constructed. In an upper layer 30, contacts 12 printed onto a flexible backing sheet 16 are joined to one another in rows 32, 34, 36. In a lower layer 38, electrical contacts 14 printed onto a backing sheet 16 are joined to one another in columns 40, 42, 44, 46. Between the two layers are the plates 18, 20 corresponding to each pair of contacts 12, 14. The upper layer 30 and the lower layer 38 are sandwiched together with the plates 18, 20 between them and are incorporated into the top of a mattress. It would of course require more sensors than are shown in Fig. 3 to cover the area of the mattress.

In order to measure the body weight distribution of a person lying on the mattress, the pressure sensor matrix is scanned by a computer controlled scanning means. Each of the sensors in row 32 is scanned and when scanning of this row is completed, the scanner moves onto row 34. As the matrix is scanned, the computer records whether or not any pressure is applied to each sensor and, if so the amount of pressure applied. For each sensor which is pressurised, the computer places a flag in its memory. Since the computer has scanned the total number of pressure sensors to which pressure is applied and the pressure applied to each of the sensors, it is a simple matter to calculate a figure B representing the total body weight of the person resting on the mattress. If the total number of sensors to which pressure is applied is represented by the letter N then an average figure for body weight distribution can be represented by B/N.

An operator inputs into the computer a danger value

developing bed sores. The invention avoids the need for constant supervision of each patient and thus relieves pressure on medical staff. Moreover, the sensors described in this invention are relatively inexpensive and can relatively easily be combined to form a matrix so that the mattress described in the invention is easy to construct.

material is carbon.

10. A bed according to claims 2 to 9 wherein the contacts are made from a material having electrical impedence value of at least 1 kilo ohm.

11. A bed according to claim 10 wherein the contacts are made from a plastics material.

12. A bed according to Claim 11 wherein the plastics material comprises polyvinylchloride impregnated with carbon.

13. In a bed an arrangement of pressure sensing devices, each device being connected to at least one reading means so as to provide an indication of pressure applied to different areas of the bed in which each of the pressure senses are located.

14. A bed according to claim 13 wherein the arrangement of sensors is connected to a scanning means so as to enable selective scanning of the sensors.

15. A bed according to claim 13 or 14 wherein the sensors are mounted on a backing sheet.

16. A bed according to claim 15 wherein the backing sheet is made of plastics material.

17. A bed according to claim 13, 14, 15 or 16 wherein the arrangement of sensors is mounted on the upper surface of the bed.

18. A bed according to claim 14 to 17, wherein holes are provided in the backing sheet to allow the passage of moisture therethrough.

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Databases searched:

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Other: Online: WPI, JAPIO, EPODOC.

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X	EP 0 136 247 A	(Brig Research)	1,13
X	WO 98/34577 A1	(Lewin Herbert)	1,13
X	US 5 253 656	(Moore) figures 1 and 2	1,13
X	US 4 172 216	(Sprague Electric)	1,13
X	US 3 836 900	(Fleet Electronics) see figures	1,2,13
A, P	WPI Acc. No. 2000-213427 & JP110342161 A (Nippondenso) see WPI abstract		

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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